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“..... per litora spargite muscum,
Naiades, et circum vitreos candidite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchyliis succo.”
N. Parthenii Giannettasi, Ecl. 1.

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I.—*On some Permo-Carboniferous Fishes from Madagascar.*
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Museum.

[Plate I. figs. 1–5.]

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MR. GEORGE G. DIXON has recently presented to the British Museum a collection of nodules containing fossil fishes, which he obtained from a shaly formation on the right bank of the Mahavavy River, opposite the village of Andogozo, near the extreme north-west coast of Madagascar. These specimens are of much interest, because they clearly belong to Upper Palæozoic types which have not hitherto been described from Madagascar* ; and they are associated with obscure traces of small freshwater shells, which Mr. R. Bullen Newton determines to be new. The shape of each nodule, as usual, depends on the contour of the contained fish, but prominent slender portions, such as parts of the caudal fin and the

* The occurrence of Permian Reptiles, Fishes, and Plants in Madagascar has been only briefly recorded by M. Boule, 'Comptes Rendus,' vol. cxlvi. (1908), p. 502.

apices of the dorsal and anal fins, are generally wanting. The fishes belong only to two genera and species, the one Platysomid, the other Coelacanth.

I. *Ecrinesomus dixonii*, gen. et sp. n. (Pl. I. figs. 1-4.)

The Platysomid fish, which attained a length of not less than 25 cm., appears to be very common, and the series of specimens obtained by Mr. Dixon exhibits nearly all its principal characters. It is very deeply fusiform, with rounded, not angulated, dorsal and ventral borders; the tail forming at least half the total length of the fish and tapering rapidly to a very slender pedicle for the caudal fin. The maximum depth of the trunk is about equal to its length from the pectoral arch to the base of the caudal fin. All the external bones and scales, with the larger rays of the median fins, are ornamented with closely-arranged parallel striæ or very fine ridges, which are generally disposed in a nearly vertical direction.

The head is always crushed in the fossils, and the parts have so much decayed that they can only be studied in impression. It is therefore difficult to distinguish the several bones. The most conspicuous element is a nearly square post-temporal plate (Pl. I. figs. 1, 2, *ptt.*), on which the vertical striation tends to become subdivided into tubercles near the upper and median border. A similar subdivision of the ornament also occurs near the median ridge of the frontal region. The cheek is completely covered with thin plates, on which the ornamental striæ sometimes tend to become concentric instead of vertical. The posterior circumorbitals (fig. 2, *po.*) seem to have been divided into more numerous plates than in known Platysomids; but this may be a false appearance due to infilled radiating branches of the traversing sensory canal. The maxilla is evidently a deepened plate, but its precise shape is uncertain. The teeth are never seen, and must have been minute. The operculum (fig. 2, *op.*) is at least twice as deep as wide, and completely covered with the nearly vertical wavy striæ, which do not conform to its border. The suboperculum (*so.p.*) is relatively small and similarly ornamented.

The endoskeleton of the trunk is imperfectly ossified, the cartilaginous vertebral arches and fin-supports being only superficially hardened and thus appearing hollow in the fossils. There are no traces of vertebral centra, and the arches are only rarely seen. A close series of neurals is exposed in the anterior part of the abdominal region in the type-specimen

(fig. 1, *n.*); but it can only be stated that they are stout rods. As shown by a vague impression in nearly all specimens (*e. g.* fig. 1, *x.*), the abdominal cavity is bordered behind by a large curved bone, which extends downwards and forwards from the vertebral axis to the origin of the anal fin. This is of uncertain nature, but evidently corresponds with a bone which is always conspicuous in the naked Permian Platysomid, *Dorypterus* *.

In the pectoral arch the clavicle is relatively large, and ends below in a convex expansion (fig. 2, *cl.*). This expansion and all the exposed plates of the arch are closely ornamented, like the head-bones, with more or less nearly vertical and wavy striations. The pectoral fin (figs. 2, 3, *pet.*) is inserted just above the expansion, on the flank, and its longest rays extend across about 12 vertical rows of flank-scales. It consists of not less than 25 rays, supported by 7 or 8 elongated, hourglass-shaped basals (*b.*), which are only superficially calcified. The foremost rays rapidly lengthen in succession at the front or upper border of the fin, and the longest rays are within its anterior or upper half. All are crossed by distant articulations, and all except the foremost lengthening rays are finely subdivided distally. The fin bears no fulcra. There are no traces of pelvic fins even in well-preserved specimens. The dorsal and anal fins are remarkably extended, the anal arising at the hinder end of the abdominal cavity and terminating on the contracted caudal pedicle, while the dorsal arises even slightly further forwards with the same hinder termination. Each fin is borne by stout endoskeletal supports much less numerous than the dermal rays; and those of the dorsal fin are clearly shown in the usual double series (fig. 4, *bo., ao.*). The two fins are similar in shape, the foremost rays being crowded, rapidly increasing in length at the anterior border to a low peak, and then more gradually shortening again until the hinder half of the fin is low and fringe-like, with less crowded and finer rays. All the rays are crossed by distant articulations, and those of the stout front portion (fig. 3 *b.*) are ornamented with oblique and partially longitudinal striæ, which are fewer and coarser than the striæ of the scale-ornament. Of the caudal fin, only the base is observable in the type-specimen (fig. 1, *c.*). The upper caudal lobe bears large ridge-scales, while the slender fin-rays are crowded and crossed by distant articulations. There are no fulcra on the median fins.

* A. Hancock and R. Howse, "On *Dorypterus hoffmanni*, Germar, from the Marl Slate of Midderidge, Durham," Quart. Journ. Geol. Soc. vol. xxvi. (1870), p. 632.

The scales completely cover the trunk and are in regular vertical series, except near the base of the anal fin, where they taper and are reflexed, and below the hinder half of the dorsal fin, where they also turn sharply forwards. As shown by impressions in the type-specimen, the inner face of each scale is smooth, thickened only at the front edge, and the peg-and-socket articulation is both wide and deep. The outer face is always completely covered with an ornament of closely-arranged striæ, which are only slightly wavy and are generally directed obliquely downwards and forwards (fig. 3 a), though sometimes almost vertical on the principal flank-scales in the anterior half of the abdominal region. The striæ of adjacent scales are not conformable, and on a few dorsal scales they sometimes show a subdivision into tubercles. On the ridge-scales of the ventral border in advance of the anal fin there is a conspicuous close series of backwardly-inclined denticles or serrations. The principal flank-scales on the anterior part of the abdominal region are more than twice as deep as wide. A single regular series of small square or oblong scales forms the base-line of the dorsal and anal fins. The course of the lateral line is only very feebly marked by a series of short vertical slits, one near the upper end of most scales in a row extending backwards from the post-temporal plate.

The fish thus described agrees with *Platysomus* and differs from all other Platysomidæ* in the relatively large size both of the square post-temporal and of the deep operculum. It also resembles the typical *Platysomus* in its external ornamentation. It is distinguished from that genus, however, by the high position of the pectoral fin on the flank and apparently by the absence of pelvic fins; also by the great relative length of its caudal region. It may therefore be referred to a new genus *Ecrinesomus*, defined as follows:—

Trunk deeply fusiform, with rounded contour, and caudal region relatively elongated. External bones and scales finely ornamented with nearly vertical striæ; post-temporal plate large and quadrate in shape; operculum much larger and deeper than suboperculum. Fin-rays distantly articulated and distally bifurcated; no fulcra. Pectoral fins large, raised on the flank; pelvic fins absent; dorsal and anal fins much extended, acuminate in front, low and fringe-like behind. Scales completely covering the trunk, in regular

* R. H. Traquair, "On the Structure and Affinities of the Platysomidæ," Trans. Roy. Soc. Edinb. vol. xxix. (1879), pp. 343-391, pls. iii.-vi.

vertical series, which taper and are reflexed at the base of the anal fin.

The type-species, of the form and proportions already described, may be appropriately named *E. dixonii*, after its discoverer.

It may be added that a single specimen of this fish was also obtained by Mr. Dixon from the Loky district in N.E. Madagascar, exactly in the same condition as the specimens from Andogozo.

II. *Cowlacanthus madagascariensis*, sp. n. (Pl. I. fig. 5.)

The only specimen of this species represents a fish about 18 cm. in total length. It is much obscured by the oxides of iron and manganese, and the head-bones and fins are crushed and broken, but it merely lacks the supplementary caudal fin. The length of the head with opercular apparatus somewhat exceeds the maximum depth of the trunk at the anterior dorsal fin, and must have equalled one quarter of the total length of the fish.

There is nothing worthy of note in the remains of the head, except that some of the cheek-plates are ornamented with the usual concentric ridges; but the operculum, which is much deeper than wide, is remarkable as being ornamented with large irregularly-ovoid tubercles, which are very closely arranged. Their appearance in impression is shown in fig. 5 *a*, magnified three times, and it is clear that they are not arranged in lines concentric with the border of the bone. In the axial skeleton of the trunk there are remains of the ordinary neural arches and caudal haemal arches, each consisting of a single piece, forked at the base and only superficially calcified. No ribs are preserved, and the air-bladder is only imperfectly indicated.

The pelvic fins are inserted just behind the anterior dorsal, which comprises nine stout rays. The posterior dorsal fin consists of very delicate though long rays, and the distance between its origin and that of the anterior dorsal equals that between the latter and the occiput. The principal caudal fin comprises about 12 rays above and below.

As shown by impressions, all the scales are ornamented with very fine and closely-arranged longitudinal ridges or striæ (fig. 5 *b*). These ridges tend to converge backwards on each scale, and they are very rarely subdivided into elongated tubercles.

In the nature of its scale-ornament, the Madagascar fossil agrees with the known Carboniferous species rather than

with the typical Upper Permian species*. It differs from all known forms in the ornamentation of its operculum, and evidently represents a new species which may be named *Cœlacanthus madagascariensis*.

EXPLANATION OF PLATE I. FIGS. 1-5.

Ganoid Fishes from a Permo-Carboniferous Formation at Andogozo, Mahavavy River, N.W. Madagascar.

- Fig. 1.* *Ecrinesomus dixonii*, gen. et sp. n.; type-specimen in right side view. The scales below the vertebral axis in the abdominal region shown as impression of inner face, the other scales as impression of outer face. (B.M. no. P. 10756.)
- Fig. 2.* Ditto; head and anterior abdominal region. (B.M. no. P. 10758.)
- Fig. 3.* Ditto; fragment showing pectoral fin, with (3*a*) flank-scale and (3*b*) portion of anal fin-rays enlarged three times. (B.M. no. P. 10759.)
- Fig. 4.* Ditto; portion of dorsal fin with some of the endoskeletal supports. (B.M. no. P. 10760.)
- Fig. 5.* *Cœlacanthus madagascariensis*, sp. n.; type-specimen, with (5*a*) portion of impression of operculum and (5*b*) scales enlarged three times. (B.M. no. P. 10768.)

a., anal fin; *ao.*, axonosts of dorsal fin; *b.*, basals of pectoral fin; *bo.*, base-osts of dorsal fin; *c.*, base of caudal fin; *cl.*, lower end of clavicle; *d.*, dorsal fin; *ll.*, scale of lateral line; *n.*, neural spines; *op.*, operculum; *orb.*, orbit; *pct.*, pectoral fin; *plt.*, post-temporal; *sop.*, sub-operculum; *x.*, internal bone at hinder border of abdominal cavity. Unless otherwise stated, the figures are of the natural size.

II.—*Notes on some Upper Palæozoic Shells from Madagascar.* By R. BULLEN NEWTON, F.G.S., of the British Museum.

[Plate I. figs. 6-11.]

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ACCOMPANYING the fish-remains discovered by Mr. George G. Dixon at Andogozo, near the west coast of the northern end of Madagascar, which are recognized by Dr. A. S. Woodward as of late Palæozoic age, are certain small mollusca of rather imperfect preservation, although sufficiently interesting to claim some remarks on this occasion.

The specimens consist of (1) a discoidal gastropod, embedded as a limonite cast on the inner surface of a narrow

* A. S. Woodward, 'Catalogue of Fossil Fishes in the British Museum,' pt. ii. (1891), pp. 399-408.